DECLARATION UNDER 37 C.F.R. §1.131 AND EXHIBITS

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EXHIBIT

CERTIFICATE OF MAILING/TRANSMISSION (37 C.F.R. 1.8A)

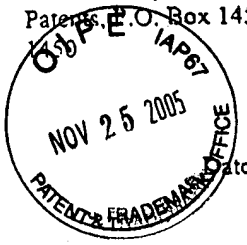
I hereby certify that this correspondence is, on the date shown below, being:

MAILING

✓ deposited with the United States Postal Service, with sufficient postage, as first class mail in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

FACSIMILE

_____ transmitted by facsimile to the Patent and Trademark Office.



Date: 11/21/05

Signature

Lisa L. Pringle

(type or print name of person certifying)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	)	
	)	
Kenneth W. Aull	)	Group Art Unit: 2133
	)	
Serial No.: 10/027,607	)	
	)	
Filed: December 19, 2001	)	Examiner: Nadia Khoshnoodi
	)	

For: *Public Key Infrastructure Token Issuance and Binding*

DECLARATION UNDER 37 C.F.R. §1.131

Sir:

We, the undersigned, declare as follows:

1. We, Kenneth W. Aull, Thomas C. Kerr, William Freeman and Mark A. Bellmore are the inventors of the invention entitled Public Key Infrastructure Token Issuance and Binding, disclosed and claimed in U.S. Patent Application Serial No. 10/027,607 (hereinafter to as "the Application"), which was filed on December 19, 2001.

2. We conceived the subject matter that is disclosed and claimed in the Application prior to December 20, 2000, while employed for a predecessor-in-interest to the Assignee.

3. Prior to December 20, 2000, we prepared a written description in the form of a PowerPoint® presentation of various aspects of a PKI architecture, including the subject matter claimed in the Application. The written description was updated on November 9, 2000, presenting evidence that the subject matter was conceived at least prior to November 9, 2000. A copy of this written description is attached hereto as Exhibit A.

4. On January 4, 2001, we completed a second written description in the form of a PowerPoint® presentation of various aspects of a PKI architecture, including the subject matter claimed in the Application. A copy of this second written description is attached hereto as Exhibit B.

5. On February 19, 2001, we submitted an invention disclosure relating to the application. A redacted copy of the invention disclosure is attached hereto as Exhibit C.

6. On April 5, 2001, a letter from Lorna Schott (Patent Administrator for the Assignee) requesting preparation of a patent application was forwarded to Donald E. Stout, Esq. at the law firm of Antonelli, Terry, Stout & Kraus, LLP. The letter included the disclosure for the invention described in the Application under docket number 15-0254. A redacted copy of the letter is attached hereto as Exhibit D.

7. On Wednesday, April 11, 2001, Henry M. Zykorie at the law firm of Antonelli, Terry, Stout & Kraus, LLP sent an email to us that included a request of additional information. A copy of the email is attached hereto as Exhibit E.

8. On Thursday, May 3, 2001, Thomas C. Kerr sent an email to Henry M. Zykorie that included the information requested in Exhibit E. A copy of the email is attached hereto as Exhibit F.

9. On June 22, 2001, Henry M. Zykorie sent a letter to Lorna L. Schott that included a draft of the Application, which was prepared by the law firm of Antonelli, Terry, Stout & Kraus, LLP. A copy of the letter is attached hereto as Exhibit G.

10. After a review of the draft of the Application, on October 18, 2001, a letter including a marked up copy of the draft of the Application was sent to Henry M. Zykorie of the law firm Antonelli, Terry, Stout & Krous, LLP. A redacted copy of this letter is attached hereto as Exhibit H.

11. On October 26, 2001, another draft of the Application was included in a letter to Lorna Schott from Henry M. Zykorie. A copy of this letter is attached hereto as Exhibit I.

12. We believe that the Application was filed in the U.S. Patent Office on December 19, 2000.

13. We declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Kenneth W. Aull 10/1/2005

Kenneth W. Aull Date

William E. Freeman 11/7/05
Date

Mark A. Bellmore 11/7/05
Date

Thomas C Kerr 10/27/2005

Thomas C. Kerr Date

EXHIBIT
A

[redacted] Class 4 PKI
The Winning Technical Strategy

Ken Aull

11/9/2000

DoD Class 4 PKI
A complex Customer set (8)

TRW

☐ Many Oars are in this water

- [redacted]
  - » Sponsor of the project - has directed that the players below be nice or lose their money
- [redacted] Class 4 Program Office
  - » Program Manager - [redacted] assigned out of [redacted]
- [redacted]
  - » [redacted] is the customer for the system. They run the Class 3 system, which by direction will be replaced with the [redacted] Class 4 system
- Common Access Card (CAC) Program
  - » Run by the [redacted] a forced marriage with the [redacted] Class 4 PKI
- Global Information Grid
  - » These people supply the Directory technology for the DoD
- [redacted]A and the KMI initiative (Key Management Initiative)
  - » [redacted] will evaluate the security - They see this as funding for their KMI program
- 22 Independent Agencies of the [redacted] - Have the bulk of the money
- Users - Not represented by anyone but the prime integrator

What is the winning technical strategy?

TRW

- TRW Enterprise Directory and Security (TEDS)
  - Not the solution for the [redacted] without significant modification
  - TEDS depends on Apriori Authoritative sources
  - [redacted] policy defines users post facto
  - TEDS depends on a well defined management structure
    - » [redacted] Chain-of-Command not well suited to this requirement
  - TEDS assumes a reasonable level of paranoia about security
    - » Technical evaluation team defines new heights of "what if" paranoia
- What TRW brings is an uncommon concern with
  - High Security
  - Low Cost
  - Strictly enforced processes and procedures
  - Replaceable COTS structures
    - » Have used both Netscape and E-Certify

The Local Registration Authority (LRA)

TRW

- The LRA is the Achilles Heel of PKI
  - A Classic LRA costs 1 full head per 2000 users
- TEDS eliminated the LRA
  - The manager became the Face-to-Face agent
- Elimination of the LRA in the [redacted] is not possible
  - The CAC officer is the LRA - a given
  - There is no authoritative source for manager
  - One of the constituents is the CAC program
    - » Will not look favorably on being eliminated
- Many of the 22 agencies ([redacted] for example)
  - Will have their own badges
  - Need to be incorporated into the process
  - These are an unfunded liability to the program

CLASS 4 Operations - an opportunity

TRW

- Class 4 implies a hardware token
- The hardware token opens the opportunity for TRW
  - Keep the CAC operators, but add no PKI overhead
  - Easily add badging operators from 22 Agencies
  - Eliminate cost of LRA function to support PKI
- The TRW primary Golden-Goo-Goo (G^3)
  - Make the CAC operator a badging operator (as intended)
  - CAC operator does no explicit LRA functions
  - User visits CAC only for badging functions
    - » To obtain the first badge
    - » To get a loaner badge for a temporary displacement
    - » To get a replacement badge for a lost badge
    - » To return a badge during check-out

The TRW CONOPS

TRW

☐ TRW concept is for an "invisible" LRA

- Functionality is hidden from the badging officer and user
- Badging officer does standard functions
  - » Identifies User via paper process
  - » Checks against "database" of users (e.g. Deers/Rapid for CAC)
  - » Checks for existing badge (Class 4 keeps record)
  - » Creates badge, including picture, fingerprint, and PKI certificate
  - » Allows user to create a PIN for the badge
  - » Signs the badge out to the user (Face-to-Face)
  - » Cancels any lost badge
  - » Issues temporary badges, logs and destroys returned badges
- From the view point of the user and the badging officer
  - » PKI appears to add no additional complexity
  - » Common [redacted] is done, no further action required, ever
  - » No additional labor over issuing a plastic badge as currently done
  - » User never revisits the LRA for ANY PKI related reason
  - » No labor expended for the support of PKI

TRW CONOPS

TRW

☐ Simple user visits badging office for a badge

- User comes away with a badge
  - » Picture for humans
  - » Digital Signature for computers and documents
- If badge is lost or expires
  - » Returning to the badge office restores picture and Digital signature
  - » Cancels (revokes) any private key stored on token
- Temporary badge creates a one-day signature
  - » Does not require canceling the permanent badge or certificate
  - » No flooding of the Certificate Revocation List (CRL)
- Returned badges only require physical destruction of badge
  - » Physical destruction eliminates any chance for use
  - » Does not require flooding of the Certificate Revocation List (CRL)

TRW Conops

TRW

- **Office worker will require Encryption certificate**
  - TRW approach allows remote generation of encryption keys
  - The private key can only be unlocked on the token (G^3)
  - The identity of the User and Badge is crytologically sound (G^3)
  - The function happens on an untrusted workstation (G^3)
    - » Removes the labor of visiting the badge office
    - » Travel, badge officer time, user time are all saved
- **Recovery of Encryption certificate is the same**
  - User uses token for identification
  - User recovers directly the encryption certificate and keys (G^3)
  - Keys are never exposed to the untrusted Workstation (G^3)

TRW Conops

TRW

- **Organizations will require Role Certificates for users**
  - Roles are created by TRW E-Form Process (G^3)
  - Roles members are managed by Role Owner identified in Form (G^3)
  - Process is entirely electronic, and definable by Sponsor (G^3)
  - Greatly simplifies the day to day management of KMI
- **Users will require Certificates for their roles**
  - User can get own role certificates via the Web (G^3)
  - No LRA is involved, just the token, the Pin and Role (G^3)
    - » Major savings in travel, LRA time, User time
  - Existing private key is RESIGNED into a role Certificate (G^3)
  - Unique process means its safe on an untrusted workstation (G^3)

TRW Conops

TRW

- **Users will have many, many badges and certificates**
  - A different badge is required on the [redacted] and [redacted]
  - Only 3.1M users will have CAC, 1M will have something else
  - Many users will have a CAC, one or more organizational badges
    - » Typical user may have four badges
  - By the nature of the token, each badge has multiple certificates
    - » Personal Identity sponsored by the badge issuer (CAC model)
    - » Personal Encryption certificate for primary email
    - » Personal Encryption certificates for secondary email addresses
    - » Role certificates for within the organization for signing
    - » Role certificates for within the organization for encryption for role
    - » Historical encryption certificates
    - » Typical badge may have from 1 to 8 certificates

TRW Conops

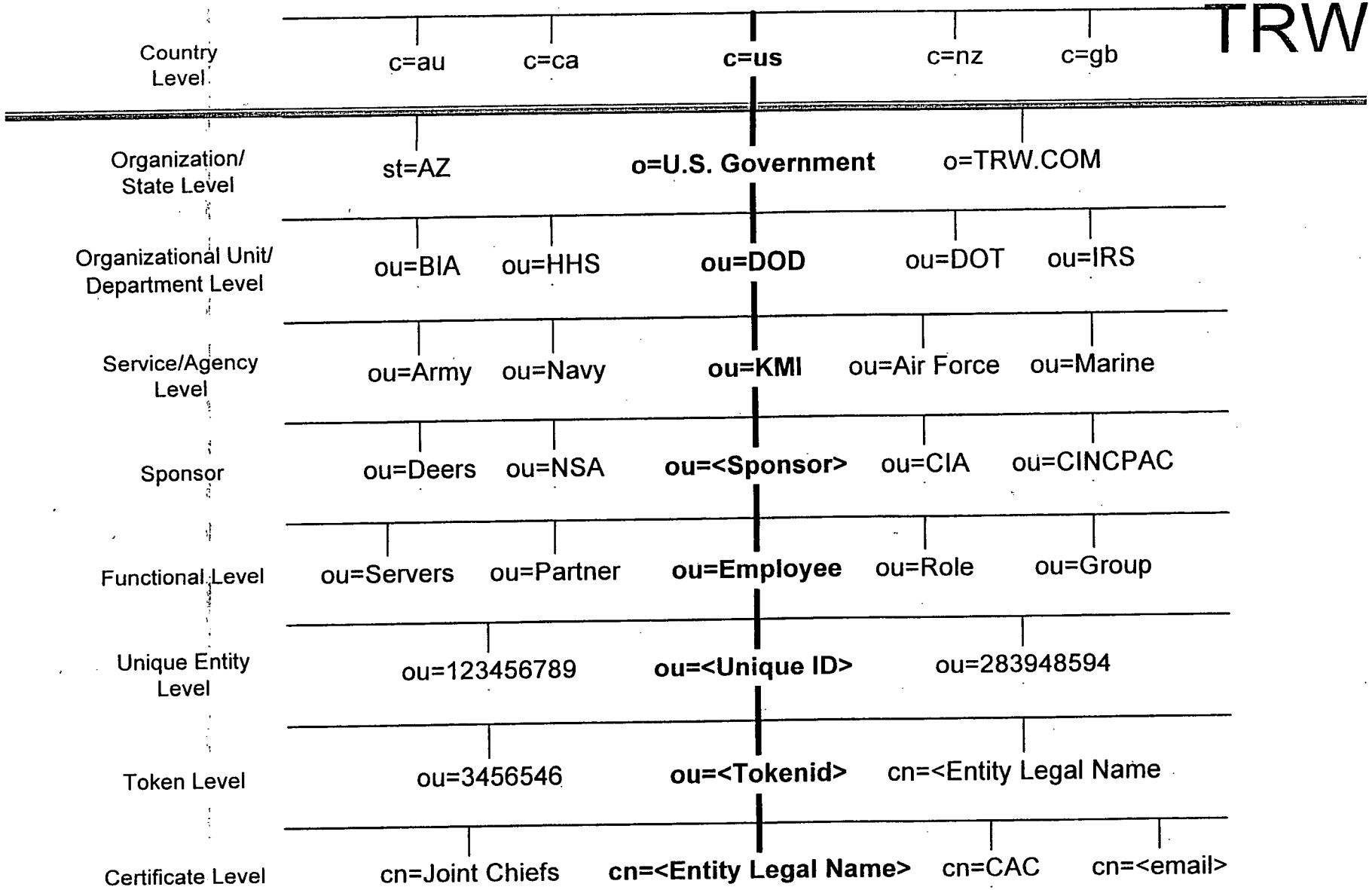
TRW

☐ TRW structures the KMI directory for GIG/PKI

- Directory is substructured by sponsor (G^3)
  - » Recognizes a person can have many sponsors (CAC, 22 agencies)
- Directory is substructured by type of sponsored entity (G^3)
  - » Employees, partners, customers, Servers, Roles, Groups
- Directory is substructured by Entity Identity (G^3)
  - » Each Sponsor supplies unique World Wide ID (WWID)
  - » Prevents identity theft
- Directory is substructured by Token (G^3)
  - » Recognizes multiple badges per identity
  - » Provides for temporary badges, prevents badge theft
  - » Provides for multiple classification levels [redacted]
- Directory is substructured by Certificate (G^3)
  - » Recognizes many certificates/keys per token
  - » Allows autorevoke of lost token

☐ TRW approaches uses replication for GIG (G^3)

TRW


Country Level
c=au
c=ca
c=us
c=nz
c=gb
Organization/ State Level
st=AZ
o=U.S. Government
o=TRW.COM
Organizational Unit/ Department Level
ou=BIA
ou=HHS
ou=DOD
ou=DOT
ou=IRS
Service/Agency Level
ou=Army
ou=Navy
ou=KMI
ou=Air Force
ou=Marine
Sponsor
ou=Deers
ou=NSA
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ou=CIA
ou=CINCPAC
Functional Level
ou=Servers
ou=Partner
ou=Employee
ou=Role
ou=Group
Unique Entity Level
ou=123456789
ou=<Unique ID>
ou=283948594
Token Level
ou=3456546
ou=<Tokenid>
cn=<Entity Legal Name
Certificate Level
cn=Joint Chiefs
cn=<Entity Legal Name>
cn=CAC
cn=<email>

The G^3 Summary - User

TRW

☐ From the User Viewpoint - Its just a badge

- [redacted] - a badge is issued with a PIN
  - » Used to sign things and visit web pages - that's all that is needed
  - » Never visit the badge office unless the badge expires or is lost
- Office Worker - a badge is issued with a PIN
  - » Used to sign things and visit web pages
  - » Also used to encrypt files and emails - self handled
  - » Recovery of historical files - self handled
  - » Never visit the badge office unless the badge expires or is lost
- Organizational Worker - a badge is issued with a PIN
  - » Used to sign things and visit web pages
  - » Also used to encrypt files and emails - self handled
  - » Recovery of historical files - self handled
  - » Issuance and recovery of role keys - self handled
  - » Never visit the badge office unless the badge expires or is lost

☐ Replace the badge every 3 years, its easy

The G³ Summary - 22 Agencies

TRW

- Each Agency controls its badging system
  - Identity totally under the control of the sponsor
    - » Identity certificates automatically issued
  - Badging under the control of the sponsor
  - PKI entities under the control of the sponsor
    - » Employees, Partners, Customers, Servers, Roles, Groups
  - Agency issues their own tokens
  - No additional operational costs at the badging office
  - Automated E-Forms system for creation of PKI entities
    - » Easily tailored to Agency requirements
  - Encryption and Role certificates - Self Handled
- Full Control of their entities
- Minimum Cost to maintain full security
- Minimal disruption and training

The G^3 Summary - [redacted] and KMI

TRW

☐ The [redacted] - a high security underpinning for KMI

- Primary identity key-pair generated at a trusted workstation
- Private identity key is generated on the token itself, never leaves
- Happens invisibly during badge generation
- Full Face-to-Face and ink signature collected as part of badging
- Additional identities, such as roles, are resigns of private key
  - » This can be done safely on untrusted workstations
  - » A major advantage for the next generation KMI
- Encryption certificates are generated at the central facility
  - » FIPS-140-3 level key generates assure the highest quality keys
  - » Keys are returned wrapped in the public key of the owner
  - » Can only be recovered on a specific token, by a specific user
  - » Fully secured even on an untrusted workstation
  - » Key recovery mechanism is fully automated for self recovery

☐ High Security and Low Cost, a win for KMI

EXHIBIT
B

TRW

Improving Key Generation & Delivery Processes for [redacted] Smart Cards

04 January 2001

Our PKI Background – Pilots (2) TRW

TRW Pilot Sep 99 – Jan 01 Netscape CMS CDC X.500 Directory fed by TRW HR's PeopleSoft database	• 1000+ X.509 signing certificates issued to employees, servers, roles, customers • VPN using Aventail servers • Employees authenticate from home using Aventail clients
[redacted] Apr 00 – Jan 01 E-Certify RA/CA Isode X.500 Directory	• 200+ signing certificates for employees, servers • Signatures for HTML based forms •7 separate pilots for PK enabled applications

Production PKI Rollout Plans

TRW

TRW [redacted] launch Encapsulated E-Certify RA/CA CDC X.500 Directory fed by TRW HR's PeopleSoft database	• 130,000 X.509 dual certificates being issued to employees, servers, roles, partners • VPN using Aventail servers • Digitally signed JettForms (XML) • ~Class 2, 3, & 4 certificates
[redacted] [redacted] launch Encapsulated E-Certify RA/CA Microsoft Active Directory	• 190,000 dual certificates to be issued to employees, servers, roles, partners, customers • Digitally signed JettForms + proprietary HTML based forms •Class 4 only

Recent Insights, Lessons Learned TRW

- If tokens have a digital identity, great things are possible
  - Discrimination between Class 2, 3, 4 certificate stores
  - Recognition of TRW versus non-TRW tokens
  - Secure, high integrity data path from CMS all the way to the token over any non-secure network, through un-trusted workstation
- Greatest long term cost savings will come from transition to signed XML forms, automated workflows
  - Eliminate most paper forms and people to push them
  - First example is reduction of labor for PKI O&M
- Tighter security, accountability, auditability
  - Non-repudiation if forms and data signed digitally
  - Data integrity if forms serialized, auto-filled, and signed by CMS

IR&D Design Goals

TRW

- Improve speed, security, & data integrity of key generation and key distribution
- Reduce number of potential points of failure
- Reduce complexity of LRA workload
- Reduce overall life cycle cost
- Eliminate need for trusted LRA workstations
- Eliminate need for personnel to re-visit LRA to obtain additional certificates (roles, encryption…)
- Simplify processes for historical recovery of encryption certificates

Rationale

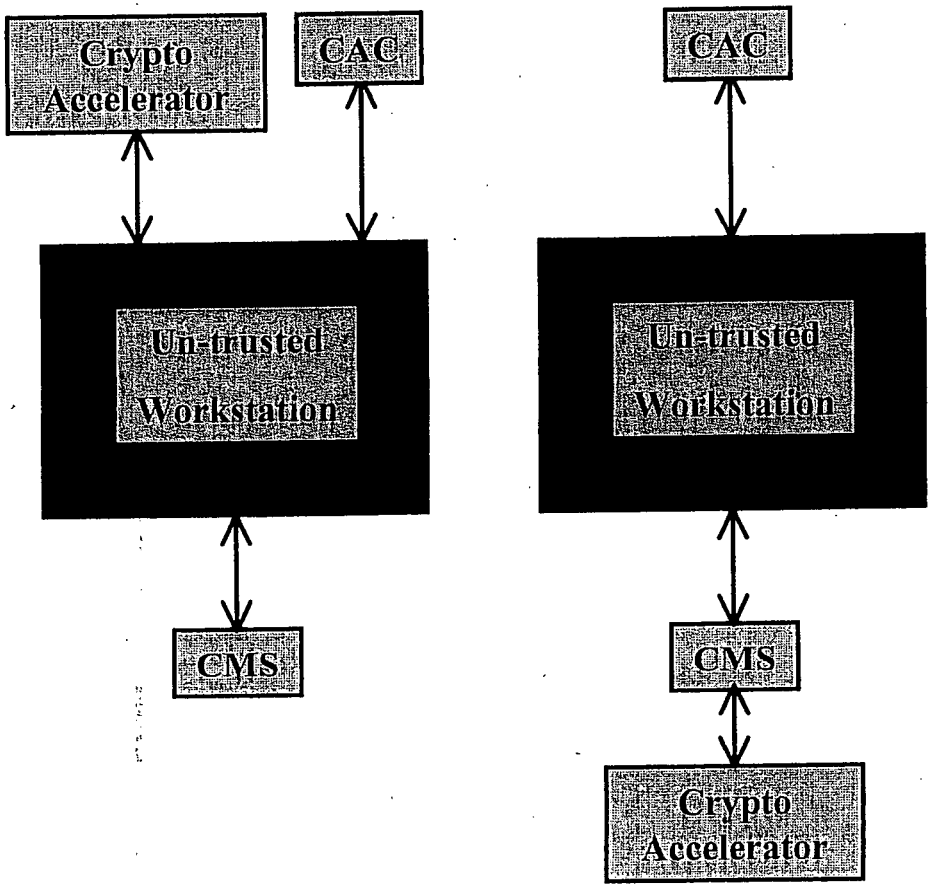
TRW

- Need for trusted LRA workstations driven by need for trusted communications between workstation & Smart Card
- Potentially simple solution:
  - Validate existing standards-based way to give each Smart Card a private key for unwrapping encrypted private keys & certificates
  - Have CA retain each card's corresponding public key in protected database or directory branch
  - Have CA wrap (encrypt) and sign all certificates intended for storage on a Smart Card using that card's public key
  - Requires only 2 trusted Smart Card key generation systems world-wide

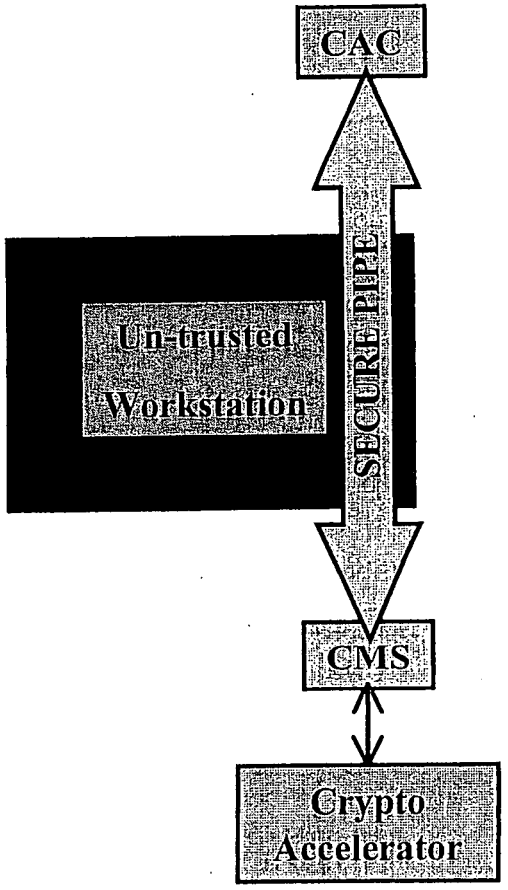
Potential Problem & Solution

TRW

Potential Problems:

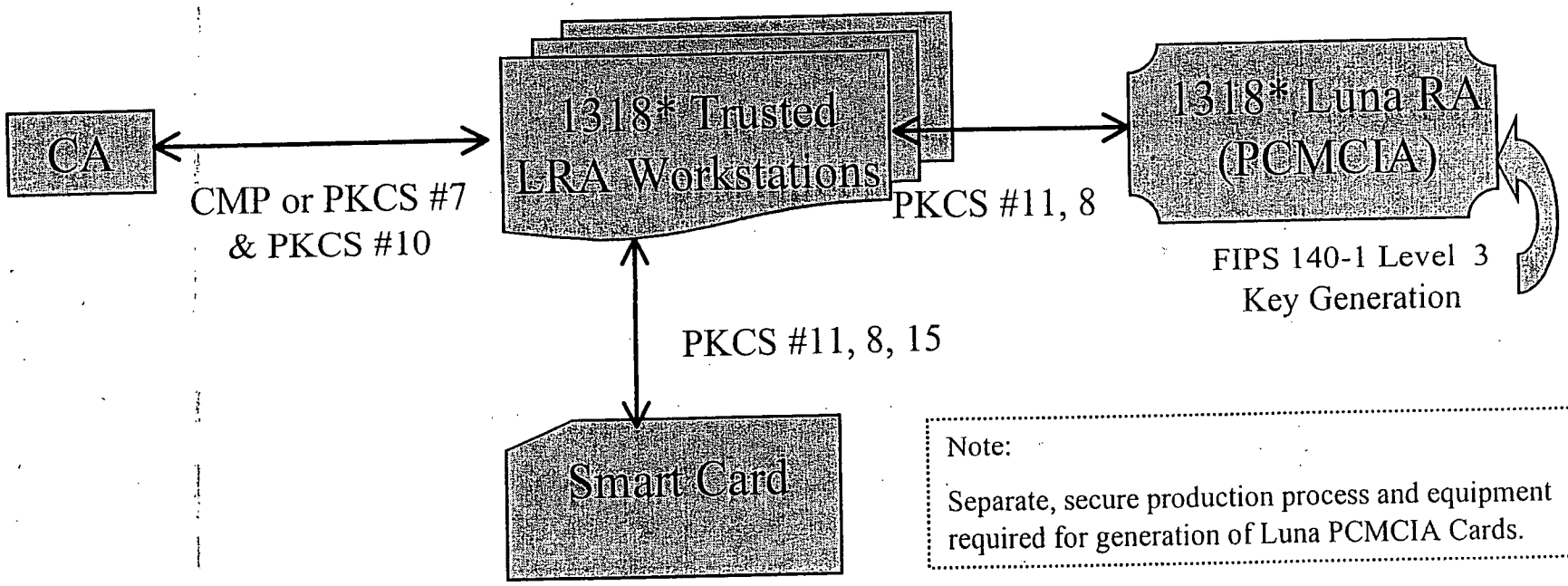


Needed Solution:



Technical Approach #1

TRW



Note:

Separate, secure production process and equipment required for generation of Luna PCMCIA Cards.

[redacted]

Pros/Con for Approach #1

TRW

- ✓ Faster, more robust key generation
- ➢ Sample costs for RAPIDS based CAC
  - o 1318 trusted workstations/environments for LRAs
  - o 1318 Chrysalis Luna PCMCIA Cards (~ $28M)
  - o Processes/facility for Luna PCMCIA Card generation
- ➢ LRA is still a critical PKI component and weakest security link (1318 potential points of compromise)
  - o Higher skills required than shown by current Class 3 PKI's E-1s and foreign nationals
- ➢ "Non-repudiation" of private key could face legal challenge since not generated on Smart Card

PKCS #12, Section 3.1, Exchange modes TRW

There are four combinations of *privacy modes* and *integrity modes*. The privacy modes use encryption to protect personal information from exposure, and the integrity modes protect personal information from tampering. Without protection from tampering, an adversary could conceivably substitute invalid information for the user's personal information without the user being aware of the substitution.

The following are the privacy modes:

- ***Public-key privacy mode:*** **Personal information is enveloped on the source platform using a trusted encryption public key of a known destination platform (see Section 3.3). The envelope is opened with the corresponding private key.**
- ***Password privacy mode:*** Personal information is encrypted with a symmetric key derived from a user name and a privacy password, as in [15]. If password integrity mode is used as well, the privacy password and the integrity password may or may not be the same.

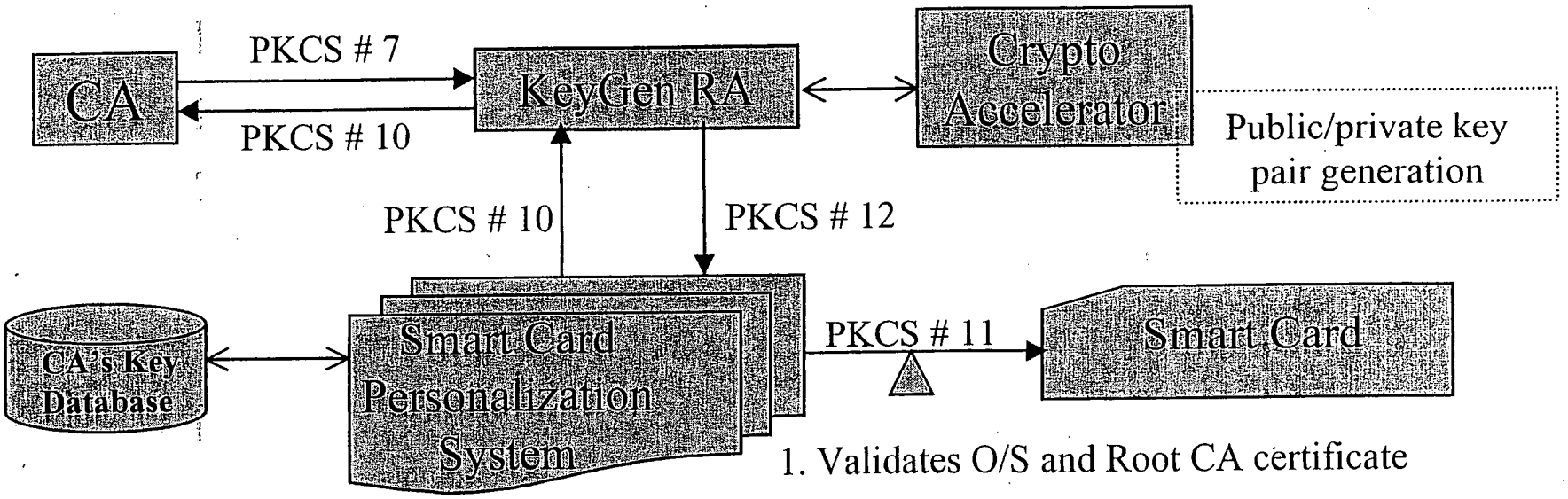
The following are the integrity modes:

- ***Public-key integrity mode*: Integrity is guaranteed through a digital signature on the contents of the PFX PDU, which is produced using the source platform's private signature key. The signature is verified on the destination platform by using the corresponding public key (see Section 3.4).**

  ***Password integrity mode*:** Integrity is guaranteed through a *message authentication code* (MAC) derived from a secret integrity password. If password privacy mode is used as well, the privacy password and the integrity password may or may not be the same.

Technical Approach #2

TRW



1. Validates O/S and Root CA certificate
2. Writes card's Private Key to S.C. ROM
3. Writes card's key encipherment certificate to protected database or directory branch

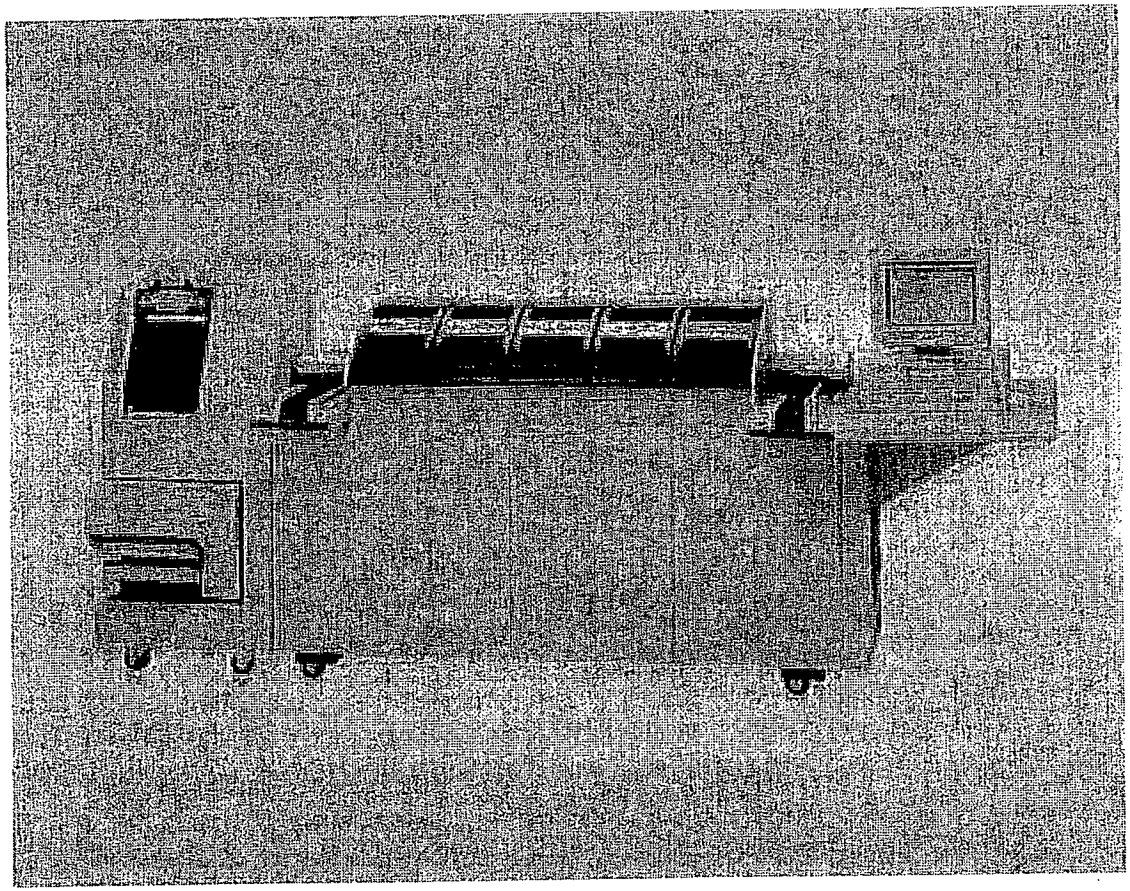
Technical Points - Approach #2 TRW

- PKI Smart-Card Key Generation System (S-CKGS) would be installed in PKI containment facilities
- S-CKGS validates O/S load and Root CA certificate for Smart Card
- S-CKGS generates unique 1024 bit key pair for each serialized Smart-Card using FIPS 140-1 Level 3 crypto accelerator
- CA signs card's public key into Key Encipherment certificate with OU=<Smart Card serial number>
- Smart Card's certificate (public key) written to protected PKI database (only CA has access to public keys for Smart Cards)
- S-CKGS writes card's private key to Smart Card ROM

➢ ***DataCard 9000 can perform this process at 900 cards per hour***

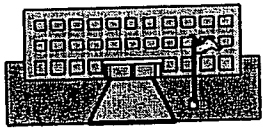
DataCard 9000

TRW

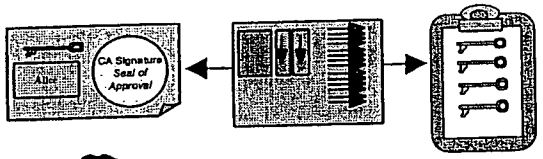


CONOPS for Smart Card Based PKI TRW

1. Smart cards are drop-shipped to CMS facility

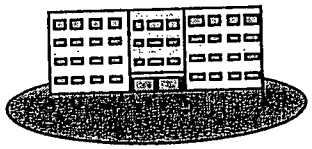


2. Smart cards are loaded with unique key wrapping keys



3. Secret key for each smart card is saved

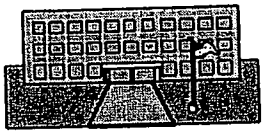
4. Smart cards shipped to badging facilities



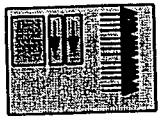
5. User visits badging Facility, presents credentials

6. Badging Officer reviews credentials

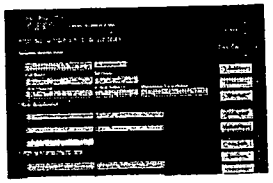
7. Badging Officer signs request for E-form with user id, Smart card ID, & organization code



8. CMS checks for redundant badge for User - previous badges are revoked/expired

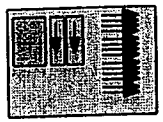


9. E-Form is auto filled at CMS from user's organizational database

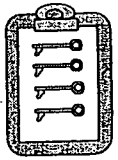


10. Badging Officer review data against credentials, signs E-Form & submits

11. CMS facility gets E-Form & validates Badging Officer signature



12. Signature key and certificate generated for User, wrapped in Smart Card's public key

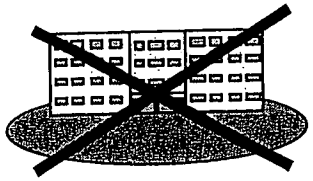


13. Badging Officer gets keys & certificate within seconds

14. Only smart card assigned to user can unwrap the private keys

15. User gets encryption, role keys & certificates at own desk

16. User never visits badge office except for lost or expired badge or termination

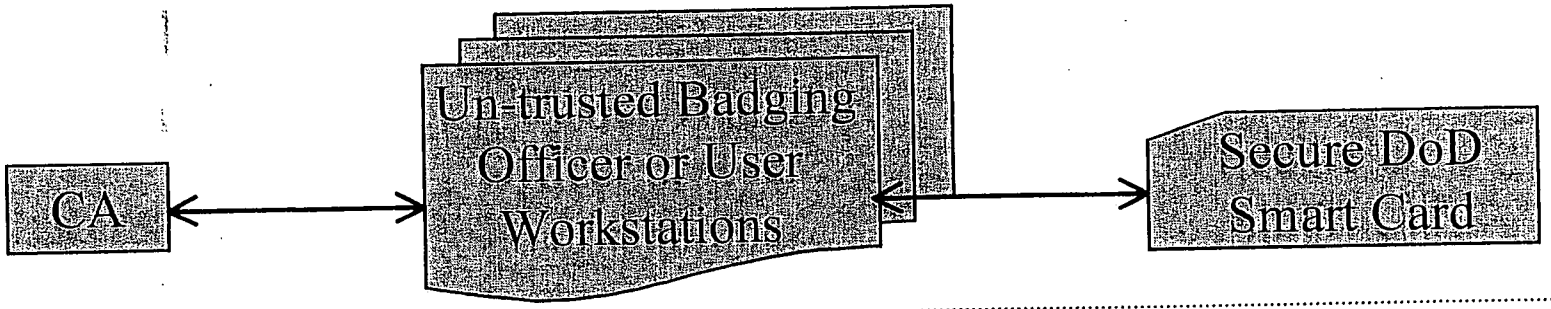


17. Badging Officer needs no trusted operating system, minimal PKI training

18. Massive reduction in operational costs with superior security

Subsequent Actions

TRW



Issuing the User's X.509 Signing Certificate:

- Badging Officer uses un-trusted workstation to bind specific Smart Card serial number to specific user ID for that C/S/A.
- CA wraps user's private key and signing certificate in public key of the specific Smart Card, signs the wrapped package, and sends via ***Public Key Privacy Mode*** and **Public Key Integrity Mode** of PKCS #12. Private key is marked as non-exportable. User bound to that Smart Card ID in CMS.

All subsequent Role, Group, and Encryption certificates:

- Badging Officer not required; users can securely obtain all other certificates from any un-trusted PC or workstation.
- CA wraps each new certificate using the user's Smart Card's public key and then signs the wrapped certificate.

Concept for Secure Forms Processing

TRW

- XML based forms from JettForms, PureEdge
- Badging Officer authenticates to RA/CA server
- Badging Officer requests badge issuance form for <User ID>, <C/S/A ID>, and <Smart Card serial number>
- CMS retrieves that C/S/A's form, assigns serial number to form, auto-fills the user's data from the authoritative database or directory, signs the form, logs it to audit trail, & issues it to Badging Officer
- Badging Officer and user validate data
- Badging Officer signs & submits finalized request

Cost / Performance Estimates

TRW

- DataCard engineers estimate that a minimum configuration DataCard 9000 can process 900 Smart Cards per hour
  - 7 parallel paths at 28 seconds per Card
  - 2 sites can process 1800 cards per hour

- ROM ~ [redacted] per 2 machines (versus [redacted])

Benefits

TRW

- Eliminates need for Badging Officers to have trusted workstations ($$)
  - Fewer points of vulnerability; lower skill levels
  - Much faster key pair generation times
- Eliminates need for 1318 remote crypto accelerators to generate key pairs ($$)
- LRA becomes simply a badging person (notary)
  - "I swear that I validated J. Doe's credentials and issued badge #130440 to him/her."
- After initial face-to-face, no need for Badging Officer for other certificate requests ($$)
- Smart Cards become integral part of central CMS
- Only CMS can load a certificate on any [redacted] Smart Card

Recommendations

TRW

Assess potential impacts to [redacted] Smart Card:

- Verify whether support for PKCS #12 is requirement under Smart Card contract(s). If so,
  - Require use of Public Key Privacy and Public Key Integrity exchange modes
  - Remove support for Password Privacy and Password Integrity exchange modes from CAC S/W
    - Note: This prevents a denial of service attack on the Smart Card.
- Assess impact of storing private key on Smart Card
- Verify whether Root CA certificate is already on CAC
- Validate potential for [redacted] cost savings

EXHIBIT
C

[redacted]

See Instructions on Website: http://webhost.trw.com/patents/

Docket: 15-0254

Date: 2/19/01

Title of Invention: PKI Token Issuance and Binding Process

Inventor(S) [See instructions on Website for assistance in determining inventorship]

(Note: to add more inventors. please press the TAB key after the last entry in the last column to insert a new row.)

Full Name **(No Initials)**	Badge	Division	CCC	TRW Mail Station	Extension	Immediate Supervisor
Kenneth Wagner Aull	150135	IS	3KLB	FP1/4165	3-5020	Bob Lentz
Thomas Carroll Kerr	130440	IS	3KLC	FP1/4165	3-5618	Kathy McLernon

*Type (NMI) if you have no middle name. Please note if you are a consultant.

Home Address	City	State	Zip Code	Home Phone	Social Security Number
Ken Aull, 5364 Lake Normandy Ct	Fairfax	VA	22030	[redacted]	[redacted]
Tom Kerr, 5348 Black Oak Dr	Fairfax	VA	22032	[redacted]	[redacted]

(No P.O. Boxes)

Conception of Invention

Date of First Written Description of the Invention: [redacted]

Identify the Written Description and Indicate Where Located:

"Card Generation Schemes.ppt" located in FP1/4165N

Date of the First Oral Disclosure: [redacted] To Whom: Mary Dixon, Defense Manpower Data Center

Date of First Drawings: [redacted] Present Location: FP1/4165N

Date of First Sketches: _____ Present Location: _____

Date of Formal Drawings, if any: _____ Present Location: _____

Construction And Test (Check Yes or No--double click on box you want checked.)

Invention Simulated? Yes ☐ No ☒ Date: _____ By Whom: _____

Invention Modeled? Yes ☐ No ☒ Date: _____ By Whom: _____

Invention Physically Constructed? Yes ☐ No ☒ Date: _____ By Whom: Ken Aull

Invention being implemented under existing

(Obtain All Signatures Before Sending to Patent Counsel)

Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Witnessed, Read and Understood by:		Witness:	Date:	Supervisor:	Date:

SYSTEMS125 Rev. 06-99

...W IR&D project

Invention Successfully Tested? Yes [redacted] No [redacted] Date: [redacted]

By Whom:

Use Or Offer For Sale (Must be Completed)

Was Invention the Subject of Commercial Activity? Yes ☒ No ☐ By Whom: Ken Aull

(Commercial Activity Means External to TRW and Includes Activity with the Government) Date: [redacted]

If Yes (A) Date of First Executed Sales Contract: [redacted]

(B) Identify First Sales Contract No.: [redacted]

(C) Date Of First Delivery To Customer: [redacted]

Was Invention Described in a Proposal? Yes [redacted] No [redacted] Date: [redacted]

Was a Description of the Invention Provided to the Government? Yes [redacted] No [redacted] Date: [redacted]

Was a Description of the Invention Provided to a Commercial Customer? Yes [redacted] No [redacted] Date: [redacted]

Was a Description of the Invention Provided as Part of an On-going Contract? Yes [redacted] No [redacted] Date: [redacted]

If you answered YES to any of the above questions, please provide a copy of the material which included the description.

Is it anticipated that an activity will occur soon? Please provide the appropriate information above and enter expected date. Yes [redacted] No [redacted] Expected Date: [redacted]

Publication [Publication means printed and distributed outside TRW] (Must be Completed)

Has a Description of the Invention Been Published? Yes ☒ No ☐

If Yes, *Provide Copy* and Identify Publication and Date: Powerpoint briefing titled "Improving Key Generation & Delivery Processes for [redacted] Smart Cards" [redacted]

If The Invention Has Been Described in a Customer Report, *Provide Copy* and Identify the Customer Report by Customer, Date, and No.

Did the Customer Report Have a TRW Proprietary Legend? Yes [redacted] No [redacted]

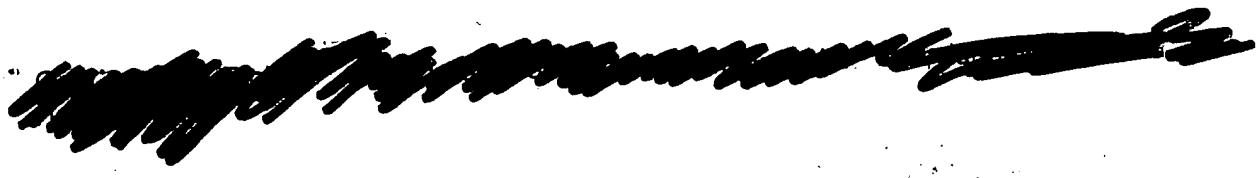
Has the Invention Been Described to People Not Employed by TRW? Yes [redacted] No [redacted]

If Yes (A) Was Disclosure Under a Confidential Disclosure Agreement? Yes

(B) Provide Names of Person(S), Their Employers(S), Date, and Place of Disclosure:

(Obtain All Signatures Before Sending to Patent Counsel)

Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Witnessed, Read and Understood by:		Witness:	Date:	Supervisor:	Date:



(Obtain All Signatures Before Sending to Patent Counsel)

Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Witnessed, Read and Understood by:		Witness:	Date:	Supervisor:	Date:

Related Printed Publications and Reference Material (Must be Completed)

Identify Any Patents, Printed Publications, Written Reports, or Proposals That You Are Aware Of Relating to Closely Analogous Concepts, and *Provide Copies:*

Identify Any Prior TRW Invention Disclosures, Patent Applications, or Issued Patents Relating to the Invention:

[redacted]

Ken Aull:

Contract or Project Information (Must be Completed)

The Invention First Conceived While Charging Time to Job No.: 99X637

And Working On: DoD PKI Marketing (OITE)

☐ Government Contract or Subcontract No.: _____ Title: _____

☐ TRW Funded (IR&D, B&P, PM&P) Project No.: _____ Title: _____

☐ Commercial Contract No.: _____ Customer: _____

☒ Other, Explanation: Working as TRW Technical Fellow

Contract Administrator and Phone No.: Bob Lentz, 703-803-4904

The Invention First Constructed While Charging Time to Job No.: _____

And Working On:

☐ Government Contract or Subcontract No.: _____ Title: _____

☐ TRW Funded (IR&D, B&P, PM&P) Project No.: _____ Title: _____

☐ Commercial Contract No.: _____ Customer: _____

☐ Other, Explanation: _____

Contract Administrator and Phone No.: _____

Tom Kerr:

Contract or Project Information (Must be Completed)

The Invention First Conceived While Charging Time to Job No.: 99X637

And Working On: DoD PKI Marketing (OITE)

☐ Government Contract or Subcontract No.: _____ Title: _____

(Obtain All Signatures Before Sending to Patent Counsel)

Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Witnessed, Read and Understood by:		Witness:	Date:	Supervisor:	Date:

☐ TRW Funded (IR&D, B&P, PM&P) _____ Title: _____
Project No.:

☐ Commercial Contract No.: _____ Customer: _____

☒ Other, Explanation: TEDS, an Internal TRW Project sponsored by Cleveland

Contract Administrator and Phone No.: [redacted]

The Invention First Constructed While Charging Time to Job No.: _____

And Working On:

☐ Government Contract or Subcontract No.: _____ Title: _____

☐ TRW Funded (IR&D, B&P, PM&P) _____ Title: _____
Project No.:

☐ Commercial Contract No.: _____ Customer: _____

☐ Other, Explanation: _____

Contract Administrator and Phone No.: _____

Tell Us All About Your Invention:

What was the problem or need that you were trying to solve?

Conventional Public Key Infrastructure (PKI) systems that utilize tokens rely on an authorized member of the enterprise to act as an agent to issue tokens to users. These Tokenizing Officers must use a specific "trusted" workstation to prepare a token for a user, and typically require some degree of specialized knowledge pertaining to PKI technology. In addition to being labor-intensive, this process opens up the token assignment process to potential tampering and mistakes by the Tokenizing Officer. This possibility endangers the integrity of an enterprise PKI system, and opens it up to later repudiation of certificate use by a user. The problem is to establish a less labor-intensive way of issuing tokens while creating a correlation between a token, a user, and all certificates stored on a token.

Inventive Concept – What is new, what it does and how it does it?

The concept allows a Tokenizing Officer to access certificate assignment procedure through a basic interface, such as a web page. It uses an enterprise Directory/Database as proof of eligibility in assigning a token to a user. It uses the existence of the Token ID (such as a serial number) and associated public certificate with the organization's Directory/Database as proof of an eligible token. It binds the certified token ID number to a certified user ID number within an organization's Directory/database. It stores a record of Tokenizing Officer's signature in correlation with creation of user signature certificate. It generates the user's signing key and certificate in the central Certificate Management System and wraps the private key/certificate in a signed and encrypted package so as to preserve the validity of non-repudiation. The public key used must be the key of the token that has been assigned to particular user. The signature must be of a subordinate

(Obtain All Signatures Before Sending to Patent Counsel)

Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Witnessed, Read and Understood by:		Witness:	Date:	Supervisor:	Date:

ertificate Authority traceable to the Root Public Certificate. It th. —ransmits the user's ertificate/private key to the Tokenizing Officer encrypted for use only by the designated token. The ystem then delivers (stores) the encrypted package to the user's token. The token is the only ntity capable of decrypting the certificate/private key. The token validates the signature of the ackage, unwraps the key and certificate, and stores them so that they are accessible via CAPI or PKCS#11 calls.

Proof of possession is obtained by requiring an initial digital signature. At that point, the certificate s tagged as being activated by publishing of the certificate within the directory.

nvention Description and Operation: (Attach Drawings Or Sketches for Each Embodiment)

A User presents credentials to the Tokenizing Officer, who enters user's ID number, organization, and token ID number into E-form Request web page. The E-form Request is sent to Certificate Management System (CMS), which checks for existing tokens for the user and revokes the certificates contained on the token. The CMS then identifies user's organization and loads an organization-specific E-form. The CMS auto-fills the E-form with data from the user's organization's directory/database and returns the auto-filled E-form to Tokenizing Officer. The Tokenizing Officer compares form data with the user credentials. The tokenizing officer electronically signs the form, and submits it back to the CMS. The CMS facility receives the form and validates the Tokenizing Officer's signature against the certificate recorded by Certificate Authority. Certificate Authority generates the user's key and signing certificate and wraps (encrypts) it using the specified token's public key. This data package is then transmitted to the Tokenizing Officer's workstation, where the Tokenizing Officer stores the data package on the token. The encrypted package contains the user's private key and public certificate. Finally, Tokenizing officer issues token to user. The Tokenizing officer retains a copy of the personally signed form in which the user accepts the token, and all its responsibilities. This meets the requirement for a traceable wet signature to any digital signature, as well as requirements for a "face-to-face", required by most high-trust CMS systems.

Finally, the user must digitally sign the E-Form for final submission to the CMS system. This signature provides proof of acceptance. Upon receiving proof of acceptance, the certificate is published in the directory by the CMS system. A compatible On-Line Certificate Status Protocol (OCSP) responder will then reply to any validation request that the certificate is now valid. The OCSP will reply with a valid response to any certificate which has been published in the directory, and which is not in the Certificate Revocation List (CRL). The OCSP will reply unknown if the CRL is not available, or current, or if the certificate is not published. The OCSP will respond invalid if the CRL indicates that the Certificate for the user has been revoked.

Briefly describe what the prior art taught:

[redacted]

(Obtain All Signatures Before Sending to Patent Counsel)

Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Inventor:	Date:	Inventor:	Date:	Inventor:	Date:
Witnessed, Read and Understood by:		Witness:	Date:	Supervisor:	Date:

[redacted]

hat are the advantages to your invention?

ıe Tokenizing Officer in this system requires no PKI-specific training, but rather needs only to be ɔle to operate a web page like interface. This Tokenizing system transmits the user's signing ɜrtificate to the Tokenizing Officer in a form that only the user's designated token can decrypt, ɜcuring it from tampering. The Tokenizing Officer's electronic signature is archived to provide an ɹdit trail in the event of signature repudiation questions or issues. These measures decrease the ɔst for training of Tokenizing personnel, and increase the integrity of the user's signing certificate.

vernment, industrial or commercial applications:

What are the current plans, if any, for the concepts discussed in the Invention Disclosure? If none, please so state.

This concept will be suggested to other commercial and government customers as part of TRW marketing activities associated with PKI or other digital signature technologies.

Is there an intended TRW commercial product that will use the concepts in this Invention Disclosure?

There is a "product" in the sense that S&ITG will offer at a pre-defined price with a pre-defined schedule a PKI "solution" to both commercial and government customers. That product is still being defined. Multiple divisions are participating in the definition of the product.

If Yes, what is the intended commercial product?

The product is an "e-business" solution that provides digital signatures and paperless workflow to an enterprise.

If Yes, when will the intended commercial product be developed?

Is there an intended TRW generic use for the concepts in this Invention Disclosure?

If Yes, what is the intended generic use?

ɔbtain All Signatures Before Sending to Patent Counsel)

ɹentor:	Date:	Inventor:	Date:	Inventor:	Date:
ɹentor:	Date:	Inventor:	Date:	Inventor:	Date:
itnessed, Read and Understood by:		Witness:	Date:	Supervisor:	Date:

Supplemental One Sheet Description - In Viewgraph Format, Tell Us About Your Invention (To be Used at Invention Evaluation Committee Meeting)

Title: PKI Token Issuance and Binding Process

Summary of Idea:

The process of using a secure electronic system to allow an authorized individual (Tokenizing Officer) within an enterprise to assign a token to a user while eliminating the possibility for compromise of the token generation process.

What Do You Believe is the Innovative Concept:

The innovative concept is that Tokenizing officer functions are reduced to the bare minimum, validating the identity of a user of the system by the comparison of database information with presented credentials. The process of recording a correlation between a token, a user, and all certificates stored on a token is "User ID Binding". This process is initiated when the Tokenizing Officer assigns a token to an entity. Once the entity and the token are *bound together* in the directory, any certificates (identity or role) that are established on the token (via encrypted download using the Primary Token Identity Certificate) are *also bound* to the entity. The Certificate subject name (in the directory tree) is designed to bind the identity or role of the user, the identity of the token, and any and all future PKI certificates together.

What is the Closest Prior Art Known to You:

[redacted]

List Competitive Advantages:

[redacted]

Reason Why We Should File a Patent for Your Invention:

[redacted]

EXHIBIT
D

TRW

Law Department

One Space Park
Redondo Beach, CA 90278
310.812.4321
E2/6051
310.812.1534
Telecopier 310.812.2687
E-mail: loma.schott@trw.com

April 5, 2001

Donald E. Stout, Esq.
Antonelli, Terry, Stout & Kraus, LLP
Suite 1800
1300 North Seventeenth Street
Arlington, Virginia 22209

Call up 1st draft [redacted]

1st draft due [redacted]
Call up appln

Subject: TRW Docket No. 15-0251
Last Day to File Application: [redacted]
Gov't. Contract No.: **Restricted**
Billing Unit: SITG/IIT-DSO - Billing Code: 312

TRW Docket No. 15-0252
Last Day to File Application: [redacted]
Gov't. Contract No.: **N/A**
Billing Unit: SITG/IIT-DSO - Billing Code: 312

199.40006X00

TRW Docket No. 15-0254
Last Day to File Application: [redacted]
Gov't. Contract No.: **N/A**
Billing Unit: SITG/IS - Billing Code: 312

TRW Docket No. 15-0255
Last Day to File Application: [redacted]
Gov't. Contract No.: **N/A**
Billing Unit: SITG/IS - Billing Code: 312

TRW Docket No. 15-0256
Last Day to File Application: [redacted]
Gov't. Contract No.: **N/A**
Billing Unit: SITG/IS - Billing Code: 312

Dear Don:

Enclosed herewith are copies of the above-referenced invention disclosures. No formal patentability searches will be conducted in these matters.

The first draft applications should be submitted to this office no later than [redacted]. **All cases have potential statutory bar dates. TRW Dockets No. 15-0254, 15-0255, and 15-0256 should be filed on the same day.** Please follow the new format for preparing the patent applications based on the new Rules and Regulations (see Federal Register/Vol. 65, No. 175/Friday, 9/8/00). The draft applications and drawings should be sent by regular U.S. mail, along with a copy of each on disk.

You should also be aware that all transmittals of drafts and comments should be directed to this office, and not directly between you and the inventor, so that I can keep track of the progress of the preparation. If you need to deviate from any of the above procedures, please contact me immediately.

Attached is a list of standards that we are now requiring for all patent application preparation. Please follow these guidelines.

The transmittal should indicate whether or not there are any statutory bars running of which you are aware, and whether or not there are any impediments to our filing corresponding foreign applications. **Your firm is also responsible for informing us if there are any related and/or co-pending applications that are to be filed at the same time.**

So that there is no question as to division of responsibilities, this office will be responsible for the preparation of the formal papers (declaration, power of attorney, assignment) and the actual filing of the applications.

I look forward to working with you to obtain the best patent coverage we can for these inventione. If you have any questions concerning these matters, please do not hesitate to contact me.

Sincerely,

Lorna L. Schott
Patent Administrator

/lls
Enclosures

PATENT APPLICATION PREPARATION STANDARDS

- The first page of the application should include: Title, Headings for Cross-reference and/or Government clauses, only when applicable (leave out if not applicable), followed by Background, Summary of Invention, etc. Do not include a separate Cover/Title page,
- The header should contain the TRW Docket Number in the upper right hand corner, as well as the Express Mail, mailing language,
- Standard government contract clause (Restricted or Unrestricted) inserted upon first draft, when applicable,
- Specification with claims,
- Drawings prepared in semi-formal format (no shading – see Guide for the Preparation of Patent Drawings – Dept. of Commerce),
- Information Disclosure Statement and Form PTO-1449 signed by you,
- Abstract (no longer than 150 words, not including the title) with reference numerals suitable for filing in foreign jurisdictions,
- Title of patent application on the abstract,
- Draft application on 8 ½" x 11" bond paper (Please follow the new format as stated in the Rules and Regulations – Federal Register/Vol. 65, No. 175),
- Copy of the application (initial drafts and subsequent drafts) on diskette readable by Microsoft Word running on a P.C. enclosed in a protective cover.
- The transmittal should also indicate whether or not there are: any related cases, statutory bars running of which you are aware, and whether or not there are any impediments to our filing corresponding foreign applications.
- All interviews with inventors should be cleared through this office. Any subsequent interviews, correspondence, or document exchange between you and the inventor should also be directed through this office, as well as copies of all documentation sent to us.

EXHIBIT
E

Henry Zykorie

From: Henry Zykorie
Sent: Wednesday, April 11, 2001 10:01 AM
To: 'ken.aull@TRW.com'; 'tom.kerr@TRW.com'
Cc: 'Lorna.schott@TRW.com'
Subject: TRW Docket #15-0254; Our Docket #199.40006 x00

Importance: High

Good morning:

My name is Henry Zykorie, and I am a patent attorney of the Washington, D.C.area law firm of Antonelli, Terry, Stout & Kraus, LLP. Our law firm has been assigned to draft/file a patent application for one of your recent TRW invention disclosures as identified above.

I would like to arrange a telephone interview with both of you in order to prepare the application. Accordingly, please tell me when will be the best time for me to call you directly to discuss about the application. Also, the following items are very helpful in facilitating discussions of the invention and/or teaching us about the technology to which the invention is related:

1) Any prior art articles and/or relevant technical publications relating the general state of the art that you might have considered during conception and preparation of your Invention Disclosure, or of which you are aware including a copy of the PowerPoint publication cited in the Invention Disclosure;

and 2) A copy of drawings, sketches and/or any text of the invention that you might have prepared for the Invention Disclosure on a floppy disk (this can be helpful for us to prepare informal drawings of the patent application for filing in the U.S. Patent & Trademark office).

Further, it is recommended that you facsimile (fax703/312-6666) or mail such materials to us in advance of any telephone conference, as it is helpful if we can both access and discuss similar materials during the telephone conference.

I would like to start working on the patent application as quickly as possible, so your promptness to confirm the above schedule would be greatly appreciated. I look forward to working with you on this patent application.

Best regards,

Henry
Henry M. Zykorie
Antonelli, Terry, Stout & Kraus LLP
1300 North Seventeenth Street
Suite 1800
Arlington, Virginia 22209
(tel) 703 312-6634
(fax) 703 312-6666
e-mail: hzykorie@antonelli.com

EXHIBIT
F

Henry Zykorie

From: Tom Kerr [Tom.Kerr@trw.com]
Sent: Thursday, May 03, 2001 8:09 AM
To: Henry Zykorie
Cc: 'Ken Aull'; 'Lorna.schott@TRW.com'
Subject: Re: TRW Docket #15-0254; Our Docket #199.40006 x00

Card Generation Schemes.ppt

Ken and I are done with the proposal that we have worked for the past 8 weeks.
I'm attaching the Powerpoint presentation cited in the invention disclosure.
Will forward additional documents and drawings that we prepared earlier for
these dockets.

Unfortunately, the company has taken 4 related PKI dockets and given them out to
four different persons to finalize the patent applications. FYI - there are 12
previous PKI patent applications filed last year by TRW - upon which this
builds.

Give us a call any time when you return to the office.

Tom Kerr
TRW Systems
1 Federal System Park Drive
Mail Stop: FP1/4165
Fairfax, VA 22033

703-803-5618

Henry Zykorie wrote:

> Hi again-
>
> Just a reminder that I had yet to receive a response to my April 11, 2001
> e-mail noted below.
>
> I await your response noting that I will be out of the office from Thursday,
> [redacted] Accordingly, please reply as soon
> as possible!
>
> Regards,
>
> Henry
>
> Henry M. Zykorie
> Antonelli, Terry, Stout & Kraus LLP
> 1300 North Seventeenth Street
> Suite 1800
> Arlington, Virginia 22209
> (tel) 703 312-6634
> (fax) 703 312-6666
> e-mail: hzykorie@antonelli.com

EXHIBIT
G

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RONALD J. SHORE
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ALAN E. SCHIAVELLI
JAMES N. DRESSER
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PAUL J. SKWIERAWSKI*
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RANDALL S. SVIHLA
HUNG H. BUI*
GEORGE N. STEVENS*
FREDERICK D. BAILEY
DAVID C. OREN
RALPH T. WEBB*

*ADMITTED OTHER THAN VA

LAW OFFICES
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ARLINGTON, VIRGINIA 22209

OF COUNSEL
HENRY M. ZYKORIE*
ROBERT F. GNUSE

PATENT AGENT
LARRY N. ANAGNOS

TELEPHONE
(703) 312-6600
FACSIMILE
(703) 312-6666

WRITER'S DIRECT EMAIL
hzykorie@antonelli.com

June 22, 2001

Lorna L. Schott
Patent Administrator
TRW Inc.
One Space Park
Redondo Beach, CA 90278

Re: DRAFT APPLICATION of TRW-150254

Dear Lorna:

We have completed the preparation of the above-identified application and enclose a paper copy of the application and drawings as well as a disc containing the application. Please advise if you need in changes made to the application. We have forwarded this via Federal Express but have not billed you for those charges.

Very truly yours,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

Henry M. Zykorie

HMZ:dmw

EXHIBIT
H

HMZ

TRW Inc.

Law Department

One Space Park
Redondo Beach, CA 90278
310.812.4321
Direct Dial No. 310.812.1534
Telecopier 310.812.2687
Building E2/6051

199.40006X00 [redacted]

DES

October 18, 2001

Henry M. Zykorie, Esq.
Antonelli, Terry, Stout & Kraus, LLP
1300 North Seventeenth Street, Ste. 1800
Arlington, VA 22209

Subject: TRW Docket No. 15-0254; Your File No. 199.40006X00
Title: PUBLIC KEY INFRASTRUCTURE TOKEN ISSUANCE AND BINDING

Dear Henry:

Enclosed please find the inventor's first review comments in connection with the above-referenced application. TRW will prepare the formal drawings. Please note there is a [redacted]. Please incorporate these changes and return the revised application to me [redacted] and include an electronic version on disk in Word 6.0 for the PC.

For your convenience, I have also enclosed the disk submitted with the original draft application.

Thank you for your attention in this matter.

Sincerely,

Lorna mlb

Lorna L. Schott
Patent Administrator

/mlb

Enclosures

EXHIBIT
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Re: TRW Docket No. 15-0254 – Our File No. 199.40006X00
Title: PUBLIC KEY INFRASTRUCTURE TOKEN ISSUANCE AND BINDING

Dear Lorna:

Thank you for your letter of October 18, 2001. We have made the requested revisions to the application and enclose the same as a paper copy as well as on disc.

Please advise if you have any further questions in connection with this application.

Very truly yours,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

By: _____
Henry M. Zykorie

HMZ:dmw
Enclosures